

# Supplementary Data 3 - Production costs and initial parameters

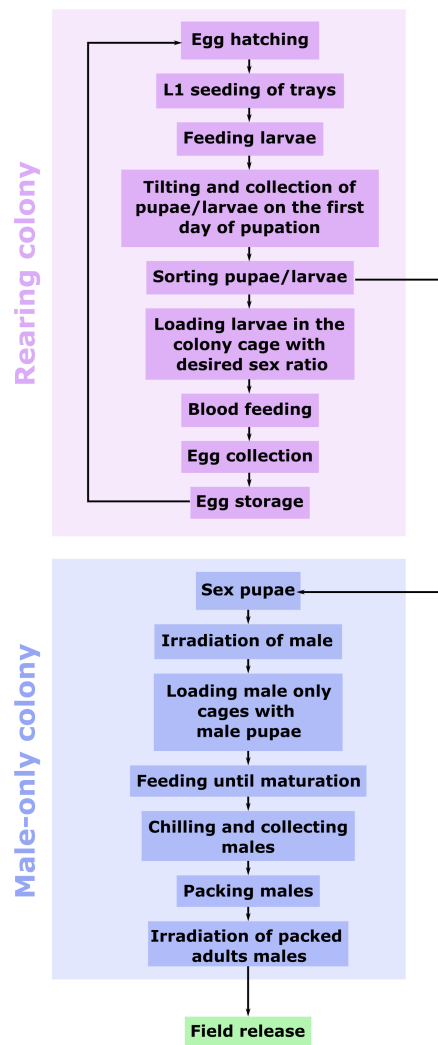
Lutrat et al. 2023

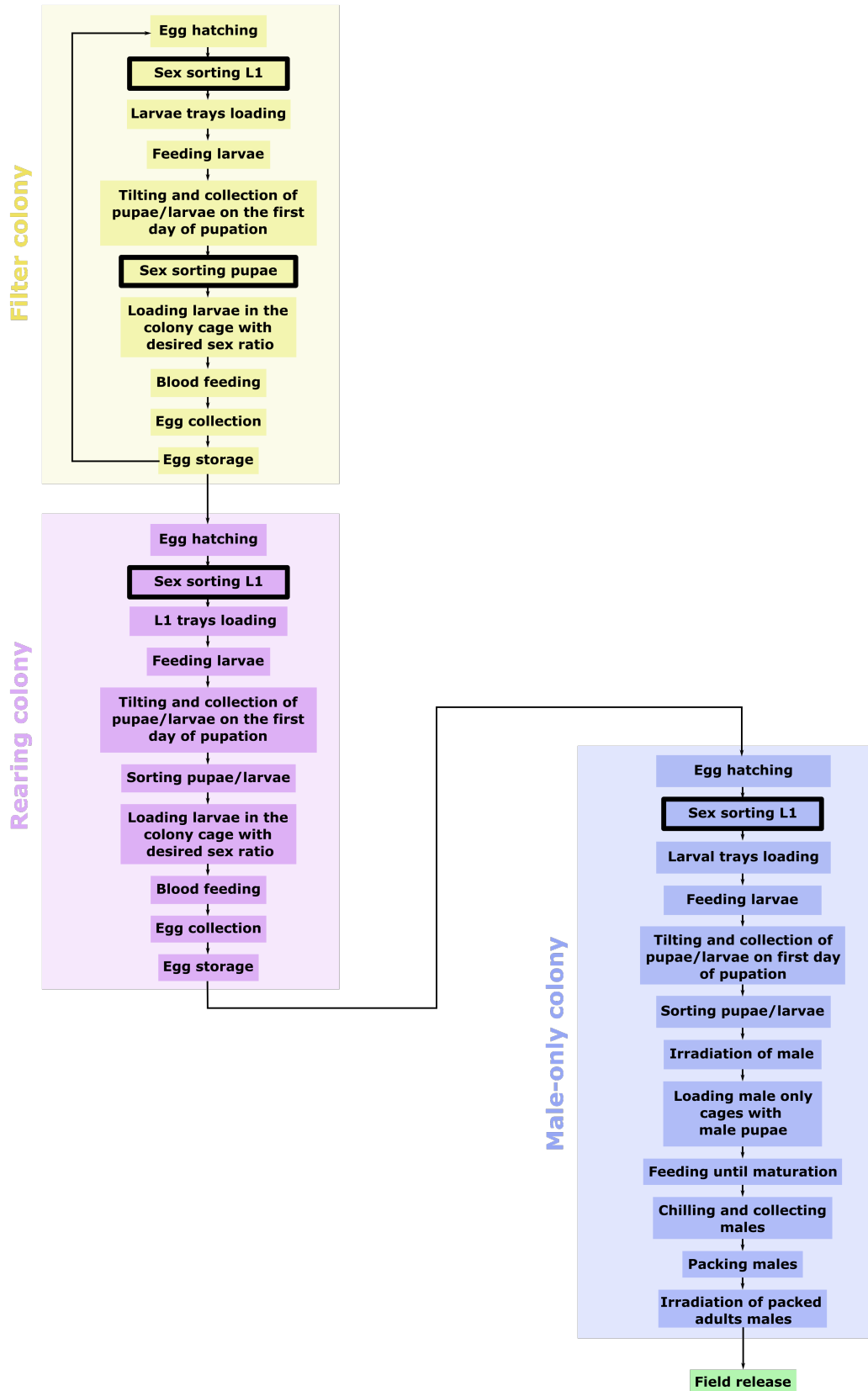
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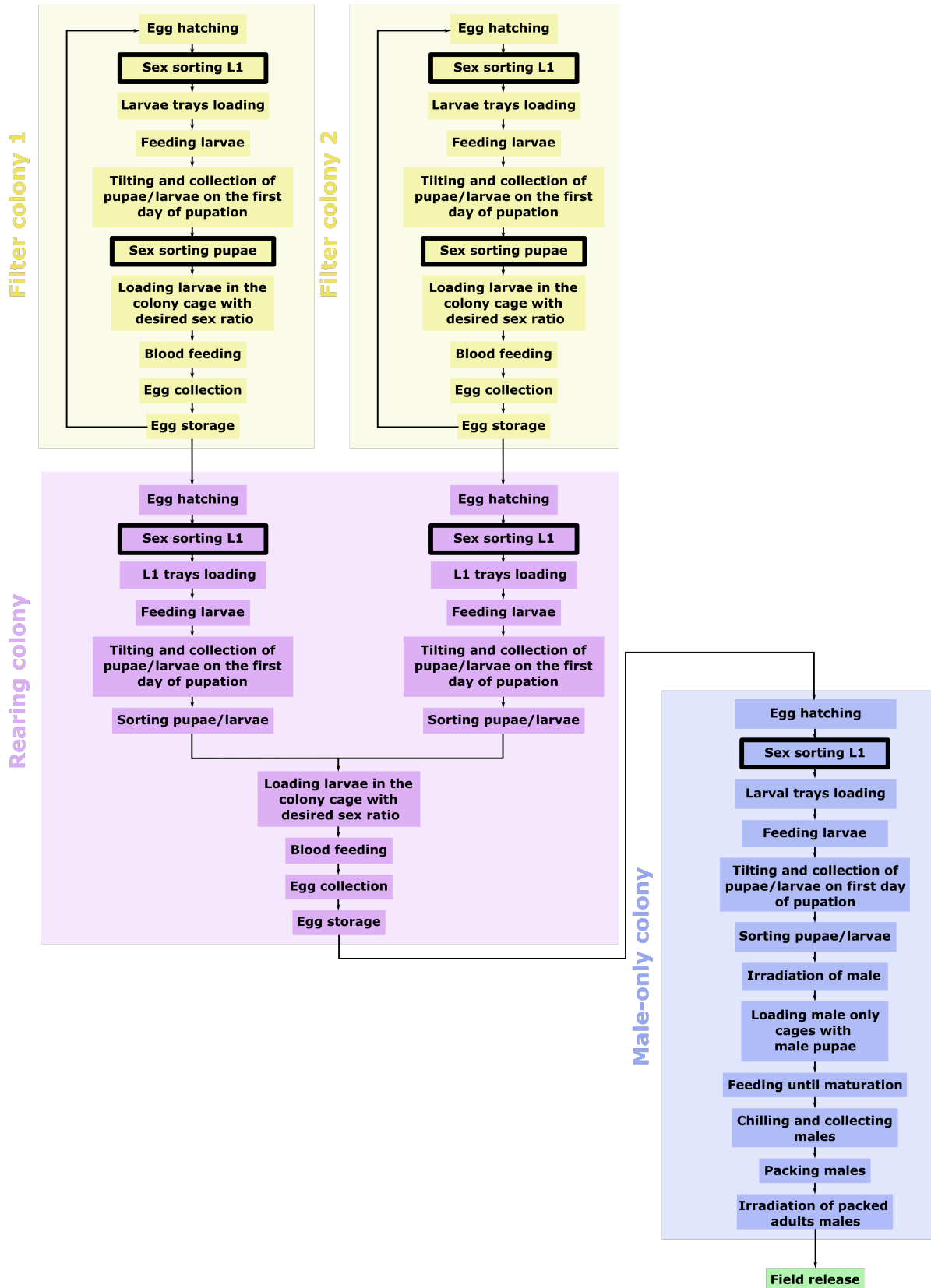
# Mass rearing processes

## Size-based sorting





GSS-CS



# Simulation outputs

## Insect production

| Number of released males (M)                             | Size manual | Size auto | GSS    | GSS-CS | GSS vs. Size manual | GSS-CS vs. Size manual |
|--|-------------|-----------|--------|--------|---------------------|------------------------|
| <b>Number of eggs to be hatched (M/day)</b>              |             |           |        |        |                     |                        |
| 5  | 7.96        | 8.44      | 5.49   | 6.46   | -2.46 (-31%)        | -1.49 (-18.8%)         |
| 10   | 15.92       | 16.88     | 10.99  | 12.93  | -4.93 (-31%)        | -2.99 (-18.8%)         |
| 20   | 31.83       | 33.75     | 21.98  | 25.86  | -9.86 (-31%)        | -5.98 (-18.8%)         |
| 50   | 79.58       | 84.38     | 54.94  | 64.64  | -24.64 (-31%)       | -14.94 (-18.8%)        |
| 100  | 159.16      | 168.76    | 109.88 | 129.28 | -49.29 (-31%)       | -29.89 (-18.8%)        |
| <b>Number of larvae in the mass-rearing facility (M)</b> |             |           |        |        |                     |                        |
| 5  | 32.98       | 34.96     | 11.56  | 17.82  | -21.42 (-65%)       | -15.16 (-46%)          |
| 10   | 65.95       | 69.93     | 23.00  | 35.53  | -42.95 (-65.1%)     | -30.42 (-46.1%)        |
| 20   | 131.91      | 139.86    | 46.01  | 71.06  | -85.90 (-65.1%)     | -60.84 (-46.1%)        |
| 50   | 329.77      | 349.65    | 114.59 | 176.90 | -215.18 (-65.3%)    | -152.86 (-46.4%)       |
| 100  | 659.53      | 699.30    | 228.96 | 353.48 | -430.57 (-65.3%)    | -306.05 (-46.4%)       |
| <b>Number of adults in the mass-rearing facility (M)</b> |             |           |        |        |                     |                        |
| 5  | 4.84        | 4.84      | 3.63   | 4.44   | -1.21 (-25%)        | -0.40 (-8.3%)          |
| 10   | 9.28        | 9.68      | 6.45   | 7.66   | -2.82 (-30.4%)      | -1.61 (-17.4%)         |
| 20   | 18.15       | 18.96     | 12.91  | 15.33  | -5.24 (-28.9%)      | -2.82 (-15.6%)         |
| 50   | 44.77       | 47.59     | 31.46  | 37.51  | -13.31 (-29.7%)     | -7.26 (-16.2%)         |
| 100  | 89.14       | 94.78     | 62.92  | 75.02  | -26.22 (-29.4%)     | -14.12 (-15.8%)        |

## Facility area

| Number of released males (M)           | Size manual | Size auto | GSS   | GSS-CS | GSS vs. Size manual | GSS-CS vs. Size manual |
|--|-------------|-----------|-------|--------|---------------------|------------------------|
| <b>Mass rearing facility area (m2)</b> |             |           |       |        |                     |                        |
| 5                                      | 535         | 539       | 417   | 470    | -118 (-22.1%)       | -65 (-12.2%)           |
| 10                                     | 839         | 876       | 565   | 661    | -274 (-32.6%)       | -178 (-21.2%)          |
| 20                                     | 1,466       | 1,519     | 893   | 1,098  | -573 (-39.1%)       | -368 (-25.1%)          |
| 50                                     | 3,321       | 3,516     | 1,895 | 2,389  | -1,427 (-43%)       | -933 (-28.1%)          |
| 100                                    | 6,437       | 6,800     | 3,553 | 4,533  | -2,884 (-44.8%)     | -1,903 (-29.6%)        |
| <b>Release facility area (m2)</b>      |             |           |       |        |                     |                        |
| 5                                      | 174         | 174       | 174   | 174    | 0 (0%)              | 0 (0%)                 |
| 10                                     | 228         | 228       | 228   | 228    | 0 (0%)              | 0 (0%)                 |
| 20                                     | 338         | 338       | 338   | 338    | 0 (0%)              | 0 (0%)                 |
| 50                                     | 667         | 667       | 667   | 667    | 0 (0%)              | 0 (0%)                 |
| 100                                    | 1,215       | 1,215     | 1,215 | 1,215  | 0 (0%)              | 0 (0%)                 |

## Workload (both facilities)

| Number of released males (M)                     | Size manual | Size auto | GSS | GSS-CS | GSS vs. Size manual | GSS-CS vs. Size manual |
|--|-------------|-----------|-----|--------|---------------------|------------------------|
| <b>Number of rearing labourers</b>               |             |           |     |        |                     |                        |
| 5  | 40          | 42        | 28  | 32     | -12 (-30%)          | -8 (-20%)              |
| 10   | 76          | 79        | 48  | 57     | -28 (-36.8%)        | -19 (-25%)             |
| 20   | 151         | 156       | 95  | 110    | -56 (-37.1%)        | -41 (-27.2%)           |
| 50   | 368         | 385       | 230 | 269    | -138 (-37.5%)       | -99 (-26.9%)           |
| 100  | 733         | 766       | 453 | 531    | -280 (-38.2%)       | -202 (-27.6%)          |
| <b>Number of QC technicians</b>                  |             |           |     |        |                     |                        |
| 5  | 4           | 4         | 2   | 3      | -2 (-50%)           | -1 (-25%)              |
| 10   | 6           | 6         | 3   | 4      | -3 (-50%)           | -2 (-33.3%)            |
| 20   | 14          | 14        | 8   | 9      | -6 (-42.9%)         | -5 (-35.7%)            |
| 50   | 36          | 37        | 21  | 25     | -15 (-41.7%)        | -11 (-30.6%)           |
| 100  | 72          | 75        | 41  | 50     | -31 (-43.1%)        | -22 (-30.6%)           |
| <b>Number of maintenance officers</b>            |             |           |     |        |                     |                        |
| 5  | 2           | 2         | 1   | 1      | -1 (-50%)           | -1 (-50%)              |
| 10   | 2           | 2         | 1   | 1      | -1 (-50%)           | -1 (-50%)              |
| 20   | 6           | 6         | 3   | 4      | -3 (-50%)           | -2 (-33.3%)            |
| 50   | 18          | 19        | 11  | 13     | -7 (-38.9%)         | -5 (-27.8%)            |
| 100  | 38          | 40        | 23  | 27     | -15 (-39.5%)        | -11 (-28.9%)           |
| <b>Total number of staff for both facilities</b> |             |           |     |        |                     |                        |
| 5  | 55          | 57        | 39  | 45     | -16 (-29.1%)        | -10 (-18.2%)           |
| 10   | 102         | 105       | 65  | 78     | -37 (-36.3%)        | -24 (-23.5%)           |
| 20   | 200         | 206       | 127 | 147    | -73 (-36.5%)        | -53 (-26.5%)           |
| 50   | 483         | 504       | 303 | 353    | -180 (-37.3%)       | -130 (-26.9%)          |
| 100  | 957         | 1,000     | 588 | 692    | -369 (-38.6%)       | -265 (-27.7%)          |

## Water requirements

| Number of released males (M)        | Size manual | Size auto | GSS    | GSS-CS | GSS vs. Size manual | GSS-CS vs. Size manual |
|-------------------------------------|-------------|-----------|--------|--------|---------------------|------------------------|
| <b>Daily water requirements (L)</b> |             |           |        |        |                     |                        |
| 5                                   | 3,704       | 3,900     | 1,580  | 2,202  | -2,124 (-57.3%)     | -1,502 (-40.6%)        |
| 10                                  | 7,403       | 7,799     | 3,142  | 4,383  | -4,261 (-57.6%)     | -3,021 (-40.8%)        |
| 20                                  | 14,802      | 15,594    | 6,284  | 8,766  | -8,518 (-57.5%)     | -6,037 (-40.8%)        |
| 50                                  | 36,999      | 38,986    | 15,658 | 21,831 | -21,341 (-57.7%)    | -15,168 (-41%)         |
| 100                                 | 73,993      | 77,968    | 31,296 | 43,630 | -42,698 (-57.7%)    | -30,364 (-41%)         |

## Construction budget

| Number of released males (M)                               | Size manual | Size auto | GSS       | GSS-CS    | GSS vs. Size manual | GSS-CS vs. Size manual |
|--|-------------|-----------|-----------|-----------|---------------------|------------------------|
| <b>Construction cost of the mass rearing facility (\$)</b> |             |           |           |           |                     |                        |
| 5  | 653,350     | 656,800   | 511,188   | 575,122   | -142,163 (-21.8%)   | -78,228 (-12%)         |
| 10   | 1,019,988   | 1,063,840 | 690,876   | 805,563   | -329,112 (-32.3%)   | -214,424 (-21%)        |
| 20   | 1,776,099   | 1,840,034 | 1,086,457 | 1,333,551 | -689,642 (-38.8%)   | -442,548 (-24.9%)      |
| 50   | 4,015,630   | 4,250,948 | 2,296,329 | 2,893,922 | -1,719,301 (-42.8%) | -1,121,708 (-27.9%)    |

(continued)

| Number of released males (M)                                 | Size manual | Size auto | GSS       | GSS-CS    | GSS vs. Size manual | GSS-CS vs. Size manual |
|--|-------------|-----------|-----------|-----------|---------------------|------------------------|
| 100  | 7,774,879   | 8,213,995 | 4,300,135 | 5,485,650 | -3,474,744 (-44.7%) | -2,289,229 (-29.4%)    |
| <b>Yearly depreciation of the mass rearing facility (\$)</b> |             |           |           |           |                     |                        |
| 5  | 32,668      | 32,840    | 25,559    | 28,756    | -7,108 (-21.8%)     | -3,911 (-12%)          |
| 10   | 50,999      | 53,192    | 34,544    | 40,278    | -16,456 (-32.3%)    | -10,721 (-21%)         |
| 20   | 88,805      | 92,002    | 54,323    | 66,678    | -34,482 (-38.8%)    | -22,127 (-24.9%)       |
| 50   | 200,782     | 212,547   | 114,816   | 144,696   | -85,965 (-42.8%)    | -56,085 (-27.9%)       |
| 100  | 388,744     | 410,700   | 215,007   | 274,282   | -173,737 (-44.7%)   | -114,461 (-29.4%)      |
| <b>Construction cost of the release facility (\$)</b>        |             |           |           |           |                     |                        |
| 5  | 237,901     | 237,901   | 237,901   | 237,901   | 0 (0%)              | 0 (0%)                 |
| 10   | 311,603     | 311,603   | 311,603   | 311,603   | 0 (0%)              | 0 (0%)                 |
| 20   | 459,006     | 459,006   | 459,006   | 459,006   | 0 (0%)              | 0 (0%)                 |
| 50   | 901,214     | 901,214   | 901,214   | 901,214   | 0 (0%)              | 0 (0%)                 |
| 100  | 1,638,082   | 1,638,082 | 1,638,082 | 1,638,082 | 0 (0%)              | 0 (0%)                 |
| <b>Yearly depreciation of the release facility (\$)</b>      |             |           |           |           |                     |                        |
| 5  | 11,895      | 11,895    | 11,895    | 11,895    | 0 (0%)              | 0 (0%)                 |
| 10   | 15,580      | 15,580    | 15,580    | 15,580    | 0 (0%)              | 0 (0%)                 |
| 20   | 22,950      | 22,950    | 22,950    | 22,950    | 0 (0%)              | 0 (0%)                 |
| 50   | 45,061      | 45,061    | 45,061    | 45,061    | 0 (0%)              | 0 (0%)                 |
| 100  | 81,904      | 81,904    | 81,904    | 81,904    | 0 (0%)              | 0 (0%)                 |

## Equipment budget

| Number of released males (M)                                    | Size manual | Size auto  | GSS        | GSS-CS     | GSS vs. Size manual | GSS-CS vs. Size manual |
|---|-------------|------------|------------|------------|---------------------|------------------------|
| <b>Mass rearing facility equipment cost (\$)</b>                |             |            |            |            |                     |                        |
| 5   | 1,093,510   | 1,831,030  | 1,247,100  | 1,448,810  | 153,590 (14%)       | 355,300 (32.5%)        |
| 10  | 1,791,920   | 3,249,980  | 1,913,010  | 2,314,060  | 121,090 (6.8%)      | 522,140 (29.1%)        |
| 20  | 3,260,960   | 6,055,430  | 3,238,590  | 4,103,040  | -22,370 (-0.7%)     | 842,080 (25.8%)        |
| 50  | 7,534,210   | 14,563,840 | 7,270,080  | 9,493,760  | -264,130 (-3.5%)    | 1,959,550 (26%)        |
| 100   | 14,751,890  | 28,653,800 | 13,933,530 | 18,352,250 | -818,360 (-5.5%)    | 3,600,360 (24.4%)      |
| <b>Mass rearing facility equipment yearly depreciation (\$)</b> |             |            |            |            |                     |                        |
| 5   | 132,888     | 207,608    | 136,497    | 159,878    | 3,608 (2.7%)        | 26,990 (20.3%)         |
| 10  | 222,067     | 369,903    | 210,832    | 257,063    | -11,235 (-5.1%)     | 34,997 (15.8%)         |
| 20  | 408,607     | 692,415    | 357,415    | 456,713    | -51,192 (-12.5%)    | 48,107 (11.8%)         |
| 50  | 950,178     | 1,665,433  | 803,147    | 1,059,787  | -147,032 (-15.5%)   | 109,608 (11.5%)        |
| 100   | 1,865,932   | 3,279,073  | 1,541,245  | 2,050,885  | -324,687 (-17.4%)   | 184,953 (9.9%)         |
| <b>Release facility equipment cost</b>                          |             |            |            |            |                     |                        |
| 5   | 88,508      | 88,508     | 88,508     | 88,508     | 0 (0%)              | 0 (0%)                 |
| 10  | 141,016     | 141,016    | 141,016    | 141,016    | 0 (0%)              | 0 (0%)                 |
| 20  | 246,032     | 246,032    | 246,032    | 246,032    | 0 (0%)              | 0 (0%)                 |
| 50  | 561,080     | 561,080    | 561,080    | 561,080    | 0 (0%)              | 0 (0%)                 |
| 100   | 1,086,076   | 1,086,076  | 1,086,076  | 1,086,076  | 0 (0%)              | 0 (0%)                 |
| <b>Release facility equipment yearly depreciation (\$)</b>      |             |            |            |            |                     |                        |
| 5   | 17,660      | 17,660     | 17,660     | 17,660     | 0 (0%)              | 0 (0%)                 |
| 10  | 29,121      | 29,121     | 29,121     | 29,121     | 0 (0%)              | 0 (0%)                 |
| 20  | 52,041      | 52,041     | 52,041     | 52,041     | 0 (0%)              | 0 (0%)                 |
| 50  | 120,803     | 120,803    | 120,803    | 120,803    | 0 (0%)              | 0 (0%)                 |
| 100   | 235,386     | 235,386    | 235,386    | 235,386    | 0 (0%)              | 0 (0%)                 |
| <b>Total equipment cost</b>                                     |             |            |            |            |                     |                        |
| 5   | 1,182,018   | 1,919,538  | 1,335,608  | 1,537,318  | 153,590 (13%)       | 355,300 (30.1%)        |

(continued)

| Number of released males (M)                    | Size manual | Size auto  | GSS        | GSS-CS     | GSS vs. Size manual | GSS-CS vs. Size manual |
|---|-------------|------------|------------|------------|---------------------|------------------------|
| 10  | 1,932,936   | 3,390,996  | 2,054,026  | 2,455,076  | 121,090 (6.3%)      | 522,140 (27%)          |
| 20  | 3,506,992   | 6,301,462  | 3,484,622  | 4,349,072  | -22,370 (-0.6%)     | 842,080 (24%)          |
| 50  | 8,095,290   | 15,124,920 | 7,831,160  | 10,054,840 | -264,130 (-3.3%)    | 1,959,550 (24.2%)      |
| 100   | 15,837,966  | 29,739,876 | 15,019,606 | 19,438,326 | -818,360 (-5.2%)    | 3,600,360 (22.7%)      |
| <b>Total equipment yearly depreciation (\$)</b> |             |            |            |            |                     |                        |
| 5   | 150,549     | 225,269    | 154,157    | 177,539    | 3,608 (2.4%)        | 26,990 (17.9%)         |
| 10  | 251,187     | 399,024    | 239,952    | 286,184    | -11,235 (-4.5%)     | 34,997 (13.9%)         |
| 20  | 460,648     | 744,456    | 409,456    | 508,755    | -51,192 (-11.1%)    | 48,107 (10.4%)         |
| 50  | 1,070,982   | 1,786,237  | 923,950    | 1,180,590  | -147,032 (-13.7%)   | 109,608 (10.2%)        |
| 100   | 2,101,317   | 3,514,459  | 1,776,631  | 2,286,271  | -324,687 (-15.5%)   | 184,953 (8.8%)         |

## Diet and consumables yearly cost

| Number of released males (M)                | Size manual | Size auto | GSS     | GSS-CS  | GSS vs. Size manual | GSS-CS vs. Size manual |
|---|-------------|-----------|---------|---------|---------------------|------------------------|
| <b>Yearly diet cost</b>                     |             |           |         |         |                     |                        |
| 5   | 30,720      | 32,346    | 13,376  | 18,742  | -17,344 (-56.5%)    | -11,978 (-39%)         |
| 10  | 61,388      | 64,692    | 26,599  | 37,327  | -34,789 (-56.7%)    | -24,061 (-39.2%)       |
| 20  | 122,723     | 129,331   | 53,169  | 74,585  | -69,553 (-56.7%)    | -48,138 (-39.2%)       |
| 50  | 306,728     | 323,340   | 132,452 | 185,717 | -174,276 (-56.8%)   | -121,011 (-39.5%)      |
| 100   | 613,402     | 646,628   | 264,721 | 371,166 | -348,681 (-56.8%)   | -242,236 (-39.5%)      |
| <b>Yearly consumables cost</b>              |             |           |         |         |                     |                        |
| 5   | 8,110       | 8,435     | 4,641   | 5,714   | -3,469 (-42.8%)     | -2,396 (-29.5%)        |
| 10  | 15,554      | 16,214    | 8,596   | 10,741  | -6,958 (-44.7%)     | -4,812 (-30.9%)        |
| 20  | 30,441      | 31,763    | 16,531  | 20,814  | -13,911 (-45.7%)    | -9,628 (-31.6%)        |
| 50  | 75,105      | 78,427    | 40,250  | 50,903  | -34,855 (-46.4%)    | -24,202 (-32.2%)       |
| 100   | 149,544     | 156,189   | 79,807  | 101,096 | -69,736 (-46.6%)    | -48,447 (-32.4%)       |
| <b>Yearly cost for diet and consumables</b> |             |           |         |         |                     |                        |
| 5   | 38,830      | 40,781    | 18,017  | 24,456  | -20,813 (-53.6%)    | -14,374 (-37%)         |
| 10  | 76,941      | 80,906    | 35,194  | 48,069  | -41,747 (-54.3%)    | -28,873 (-37.5%)       |
| 20  | 153,164     | 161,094   | 69,700  | 95,399  | -83,464 (-54.5%)    | -57,765 (-37.7%)       |
| 50  | 381,832     | 401,768   | 172,701 | 236,619 | -209,131 (-54.8%)   | -145,213 (-38%)        |
| 100   | 762,946     | 802,817   | 344,528 | 472,263 | -418,418 (-54.8%)   | -290,683 (-38.1%)      |

## Estimate of the total yearly cost for construction, equipment, diet and consumables

| Number of released males (M) | Size manual | Size auto | GSS       | GSS-CS    | GSS vs. Size manual | GSS-CS vs. Size manual |
|------------------------------|-------------|-----------|-----------|-----------|---------------------|------------------------|
| 5                            | 233,941     | 310,785   | 209,629   | 242,646   | -24,313 (-10.4%)    | 8,705 (3.7%)           |
| 10                           | 394,708     | 548,703   | 325,271   | 390,111   | -69,438 (-17.6%)    | -4,597 (-1.2%)         |
| 20                           | 725,567     | 1,020,502 | 556,430   | 693,781   | -169,138 (-23.3%)   | -31,786 (-4.4%)        |
| 50                           | 1,698,656   | 2,445,613 | 1,256,529 | 1,606,966 | -442,128 (-26%)     | -91,690 (-5.4%)        |
| 100                          | 3,334,911   | 4,809,880 | 2,418,070 | 3,114,720 | -916,842 (-27.5%)   | -220,192 (-6.6%)       |



# Initial parameters

Weekly flying male production (production) [5, 10, 20, 50, 100] M males

| Parameters   | Size manual       | Size auto         | GSS               | GSS-CS            |
|--|-------------------|-------------------|-------------------|-------------------|
| <b>Production goals</b>  |                   |                   |                   |                   |
| Weekly pupal production (Mpp/week)                               | production / 0.95 | production / 0.95 | production / 0.95 | production / 0.95 |
| <i>Rearing efficiency</i>  |                   |                   |                   |                   |
| Number of weeks with releases per year                           | 52                | 52                | 52                | 52                |
| <b>Biological parameters</b>                                     |                   |                   |                   |                   |
| Egg hatching rate  | 0.85              | 0.85              | 0.85              | 0.85              |
| Sex ratio (M/(F+M))  | 0.5               | 0.5               | 0.5               | 0.5               |
| Male pupae recovery after first sorting                          | 0.65              | 0.65              | 0.65              | 0.65              |
| Male pupae recovery after second sorting                         | 0.15              | 0.15              | 0.15              | 0.15              |
| Male pupae recovery after third sorting                          | 0.04              | 0.04              | 0.04              | 0.04              |
| Female pupae recovery after first sorting                        | 0.32              | 0.32              | 0.32              | 0.32              |
| Female pupae recovery after second sorting                       | 0.35              | 0.35              | 0.35              | 0.35              |
| Female pupae recovery after third sorting                        | 0.36              | 0.36              | 0.36              | 0.36              |
| Number of tilting or sex sorting operations for MO               | 1                 | 1                 | 1                 | 1                 |
| <b>Number of tilting or sex sorting operations for colony</b>    | <b>2</b>          | <b>2</b>          | <b>1</b>          | <b>1</b>          |
| Survival pupae to flying males                                   | 0.95              | 0.95              | 0.95              | 0.95              |
| Survival pupae to flying females                                 | 0.95              | 0.95              | 0.95              | 0.95              |
| Average number of eggs per females for the 1st gonotrophic cycle | 30                | 30                | 30                | 30                |
| Average number of eggs per females for the 2nd gonotrophic cycle | 20                | 20                | 20                | 20                |
| Average number of eggs per females for the 3rd gonotrophic cycle | 10                | 10                | 10                | 10                |
| <i>Life cycle information</i>                                    |                   |                   |                   |                   |
| Pre oviposition period (days)                                    | 8                 | 8                 | 8                 | 8                 |
| Duration of gonotrophic cycle (days)                             | 7                 | 7                 | 7                 | 7                 |
| Number of gonotrophic cycles colonies                            | 3                 | 3                 | 3                 | 3                 |
| Duration of males holding before release (days)                  | 4                 | 4                 | 4                 | 4                 |
| Duration of the larval cycle Colony (days)                       | 8                 | 8                 | 8                 | 8                 |
| Egg density (eggs/mL)  | 91000             | 91000             | 91000             | 91000             |
| Pupa density (pupae/L)   | 333333            | 333333            | 333333            | 333333            |
| <b>Capacity of main equipment</b>                                |                   |                   |                   |                   |
| <i>Larval trays</i>  |                   |                   |                   |                   |
| Density of larvae in colony trays (larvae/mL)                    | 3                 | 3                 | 3                 | 3                 |
| Depth of colony larval tray (cm)                                 | 1                 | 1                 | 1                 | 1                 |
| Larval tray length (cm)  | 60                | 60                | 60                | 60                |
| Larval tray width (cm)   | 100               | 100               | 100               | 100               |
| Height of tray columns (cm)                                      | 170               | 170               | 170               | 170               |
| Free space between trays (cm)                                    | 2.5               | 2.5               | 2.5               | 2.5               |

(continued)

| Parameters   | Size manual | Size auto | GSS  | GSS-CS |
|--|-------------|-----------|------|--------|
| <i>MO cages</i>  |             |           |      |        |
| Vertical resting space in MO cages (cm <sup>2</sup> /adult)            | 1           | 1         | 1    | 1      |
| MO cage compartment (cm <sup>2</sup> per cage)                         | 12          | 12        | 12   | 12     |
| MO cage height (cm)  | 25          | 25        | 25   | 25     |
| MO cage width (cm)   | 10          | 10        | 10   | 10     |
| MO cage length (cm)  | 6           | 6         | 6    | 6      |
| <i>Colony cages</i>  |             |           |      |        |
| Vertical resting place for colony cages (cm <sup>2</sup> /adult)       | 1.2         | 1.2       | 1.2  | 1.2    |
| Net colony cages height (cm)   | 100         | 100       | 100  | 100    |
| Net colony cages width (cm)  | 20          | 20        | 20   | 20     |
| Net colony cages length (cm)   | 90          | 90        | 90   | 90     |
| <b>Rearing task schedule</b>   |             |           |      |        |
| Frequency of blood feeding (days)                                      | 3           | 3         | 3    | 3      |
| Frequency of egg collection (days)                                     | 3           | 3         | 3    | 3      |
| Number of feeding rounds per blood membrane                            | 5           | 5         | 5    | 5      |
| Frequency of colony cage washing (holding cycle)                       | 1           | 1         | 1    | 1      |
| Frequency of MO cage washing (holding cycle)                           | 1           | 1         | 1    | 1      |
| Increase factor mother colony  | 1.08        | 1.08      | 1.08 | 1.08   |
| <b>Diet formula</b>  |             |           |      |        |
| <i>Larval diet</i>   |             |           |      |        |
| Beef liver powder (%)  | 0           | 0         | 0    | 0      |
| Tuna meal (%)  | 50          | 50        | 50   | 50     |
| Brewer yeast (%)   | 15          | 15        | 15   | 15     |
| BSF yeast (%)  | 35          | 35        | 35   | 35     |
| Component 5 (%)  | 0           | 0         | 0    | 0      |
| Component 6 (%)  | 0           | 0         | 0    | 0      |
| Concentration in water (g/mL)  | 4           | 4         | 4    | 4      |
| Ration per one larva on day 1 (mg ingredients/larva)                   | 0.66        | 0.66      | 0.66 | 0.66   |
| Ration per one larva on day 2 (mg ingredients/larva)                   | 0           | 0         | 0    | 0      |
| Ration per one larva on day 3 (mg ingredients/larva)                   | 0           | 0         | 0    | 0      |
| Ration per one larva on day 4 (mg ingredients/larva)                   | 0.66        | 0.66      | 0.66 | 0.66   |
| Ration per one larva on day 5 (mg ingredients/larva)                   | 0.44        | 0.44      | 0.44 | 0.44   |
| Ration per one larva on day 6 (mg ingredients/larva)                   | 0.66        | 0.66      | 0.66 | 0.66   |
| Ration per one larva on day 7 after 1st sorting (mg ingredients/larva) | 0           | 0         | 0    | 0      |
| Ration per one larva on day 8 after 2nd sorting (mg ingredients/larva) | 0           | 0         | 0    | 0      |
| <i>Adult diet</i>  |             |           |      |        |
| Sugar percentage in adult diets  | 10          | 10        | 10   | 10     |
| Weight of sugar per colony cage (kg/cage)                              | 0.03        | 0.03      | 0.03 | 0.03   |
| Weight of sugar per MO cage (kg/cage)                                  | 0.1         | 0.1       | 0.1  | 0.1    |
| Replenishment of water in adult cages (days)                           | 5           | 5         | 5    | 5      |

(continued)

| Parameters   | Size manual  | Size auto    | GSS          | GSS-CS       |
|--|--------------|--------------|--------------|--------------|
| Average Blood intake per female (mg/female/intake) | 1.5          | 1.5          | 1.5          | 1.5          |
| <b>Storage of ingredients</b>                      |              |              |              |              |
| Beef liver powder storage time (days)              | 90           | 90           | 90           | 90           |
| Beef liver powder storage bags per m3              | 6            | 6            | 6            | 6            |
| Beef liver powder (kg/unit)                        | 25           | 25           | 25           | 25           |
| Beef liver powder height (cm)                      | 1            | 1            | 1            | 1            |
| Tuna meal storage time (days)                      | 90           | 90           | 90           | 90           |
| Tuna meal storage bags per m3                      | 6            | 6            | 6            | 6            |
| Tuna meal (kg/unit)                                | 25           | 25           | 25           | 25           |
| Tuna meal height (cm)                              | 1            | 1            | 1            | 1            |
| Brewer yeast storage time (days)                   | 90           | 90           | 90           | 90           |
| Brewer yeast storage bags per m3                   | 6            | 6            | 6            | 6            |
| Brewer yeast (kg/unit)                             | 25           | 25           | 25           | 25           |
| Brewer yeast height (cm)                           | 1            | 1            | 1            | 1            |
| BSF yeast storage time (days)                      | 90           | 90           | 90           | 90           |
| BSF yeast storage bags per m3                      | 6            | 6            | 6            | 6            |
| BSF yeast (kg/unit)                                | 25           | 25           | 25           | 25           |
| BSF yeast height (cm)                              | 1            | 1            | 1            | 1            |
| Component 5 storage time (days)                    | 90           | 90           | 90           | 90           |
| Component 5 storage bags per m3                    | 6            | 6            | 6            | 6            |
| Component 5 (kg/unit)                              | 25           | 25           | 25           | 25           |
| Component 5 height (cm)                            | 1            | 1            | 1            | 1            |
| Component 6 storage time (days)                    | 90           | 90           | 90           | 90           |
| Component 6 storage bags per m3                    | 6            | 6            | 6            | 6            |
| Component 6 (kg/unit)                              | 25           | 25           | 25           | 25           |
| Component 6 height (cm)                            | 1            | 1            | 1            | 1            |
| Total sugar for adult diet storage time (days)     | 90           | 90           | 90           | 90           |
| Total sugar for adult diet storage bags per m3     | 6            | 6            | 6            | 6            |
| Total sugar for adult diet (kg/unit)               | 50           | 50           | 50           | 50           |
| Total sugar for adult diet height (cm)             | 1            | 1            | 1            | 1            |
| <b>Rearing equipment</b>                           |              |              |              |              |
| <i>Oversize factors</i>                            |              |              |              |              |
| Oversize factor larval trays                       | 1.3          | 1.3          | 1.3          | 1.3          |
| Oversize factor racks                              | 1.2          | 1.2          | 1.2          | 1.2          |
| Oversize factor cages                              | 1.2          | 1.2          | 1.2          | 1.2          |
| Oversize factor RM cages                           | 1.3          | 1.3          | 1.3          | 1.3          |
| <i>Irradiators</i>                                 |              |              |              |              |
| Number of pupae per irradiation canister           | 375000       | 375000       | 375000       | 375000       |
| Duration of one irradiation operation (hour)       | 0.17         | 0.17         | 0.17         | 0.17         |
| Irradiator max time (h/day)                        | 12           | 12           | 12           | 12           |
| Irradiator backup                                  | 0            | 0            | 0            | 0            |
| <i>L1 sex sorter</i>                               |              |              |              |              |
| L1 sex sorter male recovery                        | 0.696        | 0.696        | 0.696        | 0.696        |
| L1 sex sorter female recovery                      | 0.696        | 0.696        | 0.696        | 0.696        |
| L1 sex sorter throughput (M/hour)                  | 0.133        | 0.133        | 0.133        | 0.133        |
| L1 sex sorter max time (h/day)                     | 5            | 5            | 5            | 5            |
| L1 sex sorter backup                               | 1            | 1            | 1            | 1            |
| <i>Pupal sorter</i>                                |              |              |              |              |
| <b>Pupal sex sorter male recovery</b>              | <b>0.427</b> | <b>0.403</b> | <b>0.403</b> | <b>0.403</b> |
| Pupal sex sorter female recovery                   | 0.3806       | 0.3806       | 0.3806       | 0.3806       |

(continued)

| Parameters                                | Size manual | Size auto | GSS  | GSS-CS |
|---|-------------|-----------|------|--------|
| Pupal sorter throughput (Mpp/h)           | 0.05        | 0.05      | 0.05 | 0.05   |
| Pupal sorter max time (h/day)             | 5           | 5         | 5    | 5      |
| Pupal sorter backup                       | 1           | 1         | 1    | 1      |
| Male recovery for GSS filter double check | 0.9         | 0.9       | 0.9  | 0.9    |
| <i>L1 counter</i>                         |             |           |      |        |
| L1 counter capacity (tray/h)              | 20          | 20        | 20   | 20     |
| L1 counter max time                       | 4           | 4         | 4    | 4      |
| L1 counter backup                         | 1           | 1         | 1    | 1      |
| <i>Larval diet mixer</i>                  |             |           |      |        |
| Larval diet mixer capacity (trays/h)      | 40          | 40        | 40   | 40     |
| Larval diet mixer duration per batch (h)  | 0.25        | 0.25      | 0.25 | 0.25   |
| Larval diet mixer max time (h/day)        | 3           | 3         | 3    | 3      |
| Larval diet mixer backup                  | 0           | 0         | 0    | 0      |
| <i>Adult diet mixer</i>                   |             |           |      |        |
| Adult diet mixer capacity (L/operation)   | 20          | 20        | 20   | 20     |
| Adult diet mixer duration per batch (h)   | 0.25        | 0.25      | 0.25 | 0.25   |
| Adult diet mixer max time (h/day)         | 3           | 3         | 3    | 3      |
| Adult diet mixer backup                   | 0           | 0         | 0    | 0      |
| <i>Larval diet feeder</i>                 |             |           |      |        |
| Larval feeder capacity (trays/h)          | 45          | 45        | 45   | 45     |
| Larval feeder max time (h/day)            | 4           | 4         | 4    | 4      |
| Larval feeder backup                      | 1           | 1         | 1    | 1      |
| <i>Blood feeder</i>                       |             |           |      |        |
| Blood feeder capacity (cages/h)           | 2           | 2         | 2    | 2      |
| Blood feeder max time (h/day)             | 6           | 6         | 6    | 6      |
| Blood feeder backup                       | 1           | 1         | 1    | 1      |
| <i>Tray washer</i>                        |             |           |      |        |
| Tray washer capacity (trays/h)            | 200         | 200       | 200  | 200    |
| Tray washer max time (h/day)              | 6           | 6         | 6    | 6      |
| Tray washer backup                        | 0           | 0         | 0    | 0      |
| <i>Cage washer</i>                        |             |           |      |        |
| Cage washer capacity (cages/h)            | 2.4         | 2.4       | 2.4  | 2.4    |
| Cage washer max time (h/day)              | 6           | 6         | 6    | 6      |
| Cage washer backup                        | 0           | 0         | 0    | 0      |
| <i>MO cage washer</i>                     |             |           |      |        |
| MO cage washer capacity (cages/h)         | 12          | 12        | 12   | 12     |
| MO cage washer max time (h/day)           | 6           | 6         | 6    | 6      |
| MO cage washer backup                     | 0           | 0         | 0    | 0      |
| <b>Water requirement</b>                  |             |           |      |        |
| Water per tray wash (L/tray)              | 0.5         | 0.5       | 0.5  | 0.5    |
| Water per cage wash (L/cage)              | 2           | 2         | 2    | 2      |
| Water per MO cage wash (L/cage)           | 3           | 3         | 3    | 3      |
| Percentage of water for room cleaning (%) | 0.4         | 0.4       | 0.4  | 0.4    |
| <b>Floor area calculation</b>             |             |           |      |        |
| <i>Mass rearing facility</i>              |             |           |      |        |
| Rack oversize factor                      | 2           | 2         | 2    | 2      |

(continued)

| Parameters  | Size manual | Size auto | GSS  | GSS-CS |
|---|-------------|-----------|------|--------|
| Colony cage oversize factor                           | 2           | 2         | 2    | 2      |
| Storage oversize factor                               | 3           | 3         | 3    | 3      |
| Offices size per staff (m2/staff)                     | 5           | 5         | 5    | 5      |
| WC size per staff (m2/staff)                          | 3           | 3         | 3    | 3      |
| Percentage corridors (%)                              | 0.1         | 0.1       | 0.1  | 0.1    |
| Diet preparation area (m2)                            | 10          | 10        | 10   | 10     |
| Tray washing area (m2)                                | 15          | 15        | 15   | 15     |
| Cage washing area (m2)                                | 15          | 15        | 15   | 15     |
| QC lab area (m2)                                      | 20          | 20        | 20   | 20     |
| Workshop area (m2)                                    | 20          | 20        | 20   | 20     |
| Warehouse area (m2)                                   | 20          | 20        | 20   | 20     |
| Office staff (m2)                                     | 6           | 6         | 6    | 6      |
| WC staff (m2)   | 10          | 10        | 10   | 10     |
| <i>Relese facility</i>                                |             |           |      |        |
| MO cage oversize factor                               | 2           | 2         | 2    | 2      |
| MO cages loading area (m2)                            | 15          | 15        | 15   | 15     |
| MO QC lab area (m2)                                   | 20          | 20        | 20   | 20     |
| MO adult packaging area (m2)                          | 15          | 15        | 15   | 15     |
| MO diet preparation area (m2)                         | 15          | 15        | 15   | 15     |
| MO Warehouse area (m2)                                | 10          | 10        | 10   | 10     |
| MO office staff (m2)                                  | 2           | 2         | 2    | 2      |
| MO wc staff (m2)                                      | 6           | 6         | 6    | 6      |
| <b>Construction cost</b>                              |             |           |      |        |
| Cost m2 office labs wc irradiation corridor (\$/m2)   | 1500        | 1500      | 1500 | 1500   |
| Cost m2 rearing rooms (\$/m2)                         | 1200        | 1200      | 1200 | 1200   |
| Cost m2 storage warehouse (\$/m2)                     | 1000        | 1000      | 1000 | 1000   |
| Expected lifespan mass rearing facility (years)       | 20          | 20        | 20   | 20     |
| Cost m2 chilling room (\$/m2)                         | 2000        | 2000      | 2000 | 2000   |
| Expected lifespan release facility (years)            | 20          | 20        | 20   | 20     |
| <b>Workload</b>                                       |             |           |      |        |
| <i>Mass rearing facility</i>                          |             |           |      |        |
| Egg hatching work rate (h/day)                        | 2           | 2         | 2    | 2      |
| Tray hanging work rate (h/rack)                       | 0.45        | 0.45      | 0.45 | 0.45   |
| L1 dosage work rate (h/rack)                          | 0.25        | 0.25      | 0.25 | 0.25   |
| L4 loading work rate (h/rack)                         | 0.05        | 0.05      | 0.05 | 0.05   |
| Larval feeding work rate (h/rack)                     | 0.25        | 0.25      | 0.25 | 0.25   |
| Tray tilting work rate (h/rack)                       | 1           | 1         | 1    | 1      |
| Insect packing for irradiation work rate (h/canister) | 0           | 0         | 0    | 0      |
| Colony cage loading work rate (h/cage)                | 0.2         | 0.2       | 0.2  | 0.2    |
| Colony cage bloodfeeding work rate (h/cage)           | 0.05        | 0.05      | 0.05 | 0.05   |
| Egg collection work rate (h/cage)                     | 0.05        | 0.05      | 0.05 | 0.05   |
| Egg storage work rate (h/day)                         | 0           | 0         | 0    | 0      |
| Larval diet prep work rate (hour/batch)               | 0.15        | 0.15      | 0.15 | 0.15   |
| Adult diet prep work rate (hour/batch)                | 0.1         | 0.1       | 0.1  | 0.1    |
| Blood collection weekly                               | 1           | 1         | 1    | 1      |
| Blood collection work rate (hour/collection)          | 5           | 5         | 5    | 5      |
| Blood doses prep work rate (hour/dose)                | 0.1         | 0.1       | 0.1  | 0.1    |
| Net working time per staff per day (h/day)            | 7.5         | 7.5       | 7.5  | 7.5    |

(continued)

| Parameters  | Size manual  | Size auto    | GSS          | GSS-CS       |
|---|--------------|--------------|--------------|--------------|
| <i>Release facility</i>                                       |              |              |              |              |
| MO cage loading work rate (h/cage)                            | 0.1          | 0.1          | 0.1          | 0.1          |
| MO cage chilling work rate (h/cage)                           | 0.1          | 0.1          | 0.1          | 0.1          |
| MO adult collection work rate (hour/cage)                     | 0.15         | 0.15         | 0.15         | 0.15         |
| MO adult packing for release work rate (hour/cage)            | 0.1          | 0.1          | 0.1          | 0.1          |
| <i>Majoring factors</i>                                       |              |              |              |              |
| Majoring factor labourer                                      | 1.7          | 1.7          | 1.7          | 1.7          |
| Majoring factor team leader                                   | 1.5          | 1.5          | 1.5          | 1.5          |
| Majoring factor QC manager                                    | 1            | 1            | 1            | 1            |
| Majoring factor QC technician                                 | 1            | 1            | 1            | 1            |
| Majoring factor maintenance manager                           | 1            | 1            | 1            | 1            |
| Majoring factor maintenance officer                           | 1            | 1            | 1            | 1            |
| Majoring factor admin assistant                               | 1            | 1            | 1            | 1            |
| Majoring factor manager                                       | 1            | 1            | 1            | 1            |
| QC managers needed mass rearing                               | 1            | 1            | 1            | 1            |
| Manager needed mass rearing                                   | 1            | 1            | 1            | 1            |
| <b>Equipment budget</b>                                       |              |              |              |              |
| <i>Mass rearing facility</i>                                  |              |              |              |              |
| Larval trays unit price (\$)                                  | 80           | 80           | 80           | 80           |
| Larval trays life expectancy                                  | 6            | 6            | 6            | 6            |
| Racks for larval trays unit price (\$)                        | 7000         | 7000         | 7000         | 7000         |
| Racks for larval trays life expectancy (years)                | 10           | 10           | 10           | 10           |
| Cages for Colonies unit price (\$)                            | 350          | 350          | 350          | 350          |
| Cages for Colonies life expectancy (years)                    | 10           | 10           | 10           | 10           |
| Irradiator unit price (\$)                                    | 250000       | 250000       | 250000       | 250000       |
| Irradiator life expectancy (years)                            | 10           | 10           | 10           | 10           |
| L1 Sex sorter unit price (\$)                                 | 50000        | 50000        | 50000        | 50000        |
| L1 Sex sorter life expectancy (years)                         | 10           | 10           | 10           | 10           |
| <b>Pupal sex sorter unit price (\$)</b>                       | <b>40000</b> | <b>40000</b> | <b>40000</b> | <b>40000</b> |
| Pupal sex sorter life expectancy (years)                      | 10           | 10           | 10           | 10           |
| L1 counter unit price (\$)                                    | 2000         | 2000         | 2000         | 2000         |
| L1 counter life expectancy (years)                            | 5            | 5            | 5            | 5            |
| Larval diet mixer unit price (\$)                             | 3000         | 3000         | 3000         | 3000         |
| Larval diet mixer life expectancy (years)                     | 5            | 5            | 5            | 5            |
| Adult diet mixer unit price (\$)                              | 2000         | 2000         | 2000         | 2000         |
| Adult diet mixer life expectancy (years)                      | 6            | 6            | 6            | 6            |
| Larval diet feeder unit price (\$)                            | 3000         | 3000         | 3000         | 3000         |
| Larval diet feeder life expectancy (years)                    | 5            | 5            | 5            | 5            |
| Blood feeders unit price (\$)                                 | 2000         | 2000         | 2000         | 2000         |
| Blood feeders life expectancy (years)                         | 5            | 5            | 5            | 5            |
| Tray washing machine in mass rearing facility unit price (\$) | 20000        | 20000        | 20000        | 20000        |

(continued)

| Parameters  | Size manual | Size auto | GSS   | GSS-CS |
|---|-------------|-----------|-------|--------|
| Tray washing machine in mass rearing facility life expectancy (years) | 6           | 6         | 6     | 6      |
| Cage washing machine in mass rearing facility unit price (\$)         | 20000       | 20000     | 20000 | 20000  |
| Cage washing machine in mass rearing facility life expectancy (years) | 6           | 6         | 6     | 6      |
| Equipment for basic QC lab number                                     | 1           | 1         | 1     | 1      |
| Equipment for basic QC lab unit price (\$)                            | 12000       | 12000     | 12000 | 12000  |
| Equipment for basic QC lab life expectancy (years)                    | 5           | 5         | 5     | 5      |
| Workshop equipment number   | 1           | 1         | 1     | 1      |
| Workshop equipment unit price (\$)                                    | 25000       | 25000     | 25000 | 25000  |
| Workshop equipment life expectancy (years)                            | 10          | 10        | 10    | 10     |
| Blood storage number  | 1           | 1         | 1     | 1      |
| Blood storage unit price (\$)   | 5000        | 5000      | 5000  | 5000   |
| Blood storage life expectancy (years)                                 | 6           | 6         | 6     | 6      |
| <i>Relese facility</i>  |             |           |       |        |
| Cages for Release Males unit price (\$)                               | 84          | 84        | 84    | 84     |
| Cages for Release Males life expectancy (years)                       | 4           | 4         | 4     | 4      |
| Cage washing machine in release facility unit price (\$)              | 20000       | 20000     | 20000 | 20000  |
| Cage washing machine in release facility life expectancy (years)      | 6           | 6         | 6     | 6      |
| Equipment for basic QC lab MO number                                  | 1           | 1         | 1     | 1      |
| Equipment for basic QC lab MO unit price (\$)                         | 6000        | 6000      | 6000  | 6000   |
| Equipment for basic QC lab MO life expectancy (years)                 | 5           | 5         | 5     | 5      |
| Workshop equipment MO number  | 1           | 1         | 1     | 1      |
| Workshop equipment MO unit price (\$)                                 | 10000       | 10000     | 10000 | 10000  |
| Workshop equipment MO life expectancy (years)                         | 6           | 6         | 6     | 6      |
| Beef liver powder unit cost (\$/kg)                                   | 80          | 80        | 80    | 80     |
| <b>Diet and consumable costs</b>                                      |             |           |       |        |
| Tuna meal unit cost (\$/kg)   | 0.7         | 0.7       | 0.7   | 0.7    |
| Brewer yeast unit cost (\$/kg)  | 8.5         | 8.5       | 8.5   | 8.5    |
| BSF powder unit cost (\$/kg)  | 8.5         | 8.5       | 8.5   | 8.5    |
| Component 5 unit cost (\$/kg)   | 0           | 0         | 0     | 0      |
| Component 6 unit cost (\$/kg)   | 0           | 0         | 0     | 0      |
| Water including the initial load of trays unit cost (\$/L)            | 3           | 3         | 3     | 3      |
| Sugar for adult colony unit cost (\$/kg)                              | 1           | 1         | 1     | 1      |
| Blood for adult diet unit cost (\$/L)                                 | 2           | 2         | 2     | 2      |
| Radiation dosimeters unit cost (\$)                                   | 1.5         | 1.5       | 1.5   | 1.5    |
| Consumables without inventoring unit cost (\$)                        | 0.2         | 0.2       | 0.2   | 0.2    |